

# SEQUENCE LISTING

<110> The Government of the United States of America, as represented by the Secretary of the Department of Health and Human Services, Centers for Disease Control and Prevention

Lal, Altaf A.

Ping Shi, Ya

Hasnain, Seyed E.

<120> Recombinant Multivalent Malarial Vaccine Against Plasmodium Falciparum

<130> 6395-57049

<140> 09/763,397

<141> 2001-02-16

<150> US 60/097,703

<151> 1998-08-21

<150> PCT / US99/18869

<151> 1999-08-19

<160> 26

<170> PatentIn version 3.1

<210> 1

<211> 1053

<212> DNA

<213> Artificial Sequence

<220>

<223> Recombinant DNA/Protein

<220>

<221> CDS

<222> (1)..(1053)

<223>

<400> 1

atg	aaa	ttc	tta	gtc	aac	gtt	gcc	ctt	gtt	ttt	atg	gtc	gtg	tac	att	48
Met	Lys	Phe	Leu	Val	Asn	Val	Ala	Leu	Val	Phe	Met	Val	Val	Tyr	Ile	
1			5						10					15		

tct	tac	atc	tat	gcg	gat	cat	cat	cat	cat	cat	cat	aaa	cat	aaa	aaa	96
Ser	Tyr	Ile	Tyr	Ala	Asp	His	His	His	His	His	His	Lys	His	Lys	Lys	
			20					25						30		

tta	aag	caa	cca	ggg	gat	ggt	aat	cct	tggtcc	cca	tgt	agt	gta	act	144
Leu	Lys	Gln	Pro	Gly	Asp	Gly	Asn	Pro	Trp	Ser	Pro	Cys	Ser	Val	Thr
		35					40					45			

tgt	gga	aaa	cct	aaa	gac	gaa	tta	gat	tat	gaa	aat	gat	att	gaa	aaa	192
Cys	Gly	Lys	Pro	Lys	Asp	Glu	Leu	Asp	Tyr	Glu	Asn	Asp	Ile	Glu	Lys	
	50					55					60					

aaa	att	tgt	aaa	atg	gaa	aaa	tgt	tcc	agt	gtg	ttt	aat	gtc	gta	aat	240
Lys	Ile	Cys	Lys	Met	Glu	Lys	Cys	Ser	Ser	Val	Phe	Asn	Val	Val	Asn	
65						70					75				80	

agt aat tct gga tgt ttc aga cat tta gat gaa aga gaa gaa tgt aaa Ser Asn Ser Gly Cys Phe Arg His Leu Asp Glu Arg Glu Glu Cys Lys 85 90 95	288
tgt tta tta gaa gat tca ggt agc aac gga aag aaa atc aca tgt gaa Cys Leu Leu Glu Asp Ser Gly Ser Asn Gly Lys Lys Ile Thr Cys Glu 100 105 110	336
tgt act aaa cct gat tct aag cct att gtg caa tat gac aat ttc aat Cys Thr Lys Pro Asp Ser Lys Pro Ile Val Gln Tyr Asp Asn Phe Asn 115 120 125	384
gca aac cca aac gca aac ccc aat gca aat cct gat gga aat tgt gaa Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asp Gly Asn Cys Glu 130 135 140	432
gat ata cca cat gta aat gaa ttt tca gca att gat ctt gga aat gct Asp Ile Pro His Val Asn Glu Phe Ser Ala Ile Asp Leu Gly Asn Ala 145 150 155 160	480
gaa aaa tat gat aaa atg gat gaa cca caa cat tat ggg aaa tca ctc Glu Lys Tyr Asp Lys Met Asp Glu Pro Gln His Tyr Gly Lys Ser Leu 165 170 175	528
act cca tta gaa gaa tta tat aaa cca aat gat aaa agt ttg tat cag Thr Pro Leu Glu Glu Leu Tyr Lys Pro Asn Asp Lys Ser Leu Tyr Gln 180 185 190	576
tat ata aaa gca aat tct aaa ttt ata ggt ata act gaa cta agc aac Tyr Ile Lys Ala Asn Ser Lys Phe Ile Gly Ile Thr Glu Leu Ser Asn 195 200 205	624
aca ttc ata aac aat gct gga caa cat gga cat atg cat ggt aac gag Thr Phe Ile Asn Asn Ala Gly Gln His Gly His Met His Gly Asn Glu 210 215 220	672
agg gaa gat gag aga acg ctt act aag gaa tat gaa gat att gtt ttg Arg Glu Asp Glu Arg Thr Leu Thr Lys Glu Tyr Glu Asp Ile Val Leu 225 230 235 240	720
aaa gag ttt aca tat atg ata aac ttt gga aga gga cag aat tat tgg Lys Glu Phe Thr Tyr Met Ile Asn Phe Gly Arg Gly Gln Asn Tyr Trp 245 250 255	768
gaa cat cca tat caa aaa agt gat caa cct aaa caa tat gaa caa cat Glu His Pro Tyr Gln Lys Ser Asp Gln Pro Lys Gln Tyr Glu Gln His 260 265 270	816
tta aca gat tat gaa aaa att aaa gaa ggt aag ccc ttg gat aaa ttt Leu Thr Asp Tyr Glu Lys Ile Lys Glu Gly Lys Pro Leu Asp Lys Phe 275 280 285	864
gga aat atc tat gat tat cac tat gag cat tct agt cca tct agt aca Gly Asn Ile Tyr Asp Tyr His Tyr Glu His Ser Ser Pro Ser Ser Thr 290 295 300	912
aag tca tca agt cca tca aat gta aaa tca gct agt cta gct aca aga Lys Ser Ser Ser Pro Ser Asn Val Lys Ser Ala Ser Leu Ala Thr Arg 305 310 315 320	960

tta atg aaa aaa ttt aaa gct gaa atc aga gat ttc ttc ggt ata agt 1008  
 Leu Met Lys Lys Phe Lys Ala Glu Ile Arg Asp Phe Phe Gly Ile Ser  
                   325                  330                  335

tat tat gaa aag gtt tta gcg aaa tat aag gat gat tta gaa tag 1053  
 Tyr Tyr Glu Lys Val Leu Ala Lys Tyr Lys Asp Asp Leu Glu  
                   340                  345                  350

<210> 2  
 <211> 350  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Recombinant DNA/Protein

<400> 2

Met Lys Phe Leu Val Asn Val Ala Leu Val Phe Met Val Val Tyr Ile  
 1                  5                  10                  15

Ser Tyr Ile Tyr Ala Asp His His His His His His Lys His Lys Lys  
                   20                  25                  30

Leu Lys Gln Pro Gly Asp Gly Asn Pro Trp Ser Pro Cys Ser Val Thr  
                   35                  40                  45

Cys Gly Lys Pro Lys Asp Glu Leu Asp Tyr Glu Asn Asp Ile Glu Lys  
                   50                  55                  60

Lys Ile Cys Lys Met Glu Lys Cys Ser Ser Val Phe Asn Val Val Asn  
 65                  70                  75                  80

Ser Asn Ser Gly Cys Phe Arg His Leu Asp Glu Arg Glu Glu Cys Lys  
                   85                  90                  95

Cys Leu Leu Glu Asp Ser Gly Ser Asn Gly Lys Lys Ile Thr Cys Glu  
                   100                  105                  110

Cys Thr Lys Pro Asp Ser Lys Pro Ile Val Gln Tyr Asp Asn Phe Asn  
                   115                  120                  125

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asp Gly Asn Cys Glu  
                   130                  135                  140

Asp Ile Pro His Val Asn Glu Phe Ser Ala Ile Asp Leu Gly Asn Ala  
 145                  150                  155                  160

Glu Lys Tyr Asp Lys Met Asp Glu Pro Gln His Tyr Gly Lys Ser Leu  
                   165                  170                  175

Thr Pro Leu Glu Glu Leu Tyr Lys Pro Asn Asp Lys Ser Leu Tyr Gln  
180 185 190

Tyr Ile Lys Ala Asn Ser Lys Phe Ile Gly Ile Thr Glu Leu Ser Asn  
195 200 205

Thr Phe Ile Asn Asn Ala Gly Gln His Gly His Met His Gly Asn Glu  
210 215 220

Arg Glu Asp Glu Arg Thr Leu Thr Lys Glu Tyr Glu Asp Ile Val Leu  
225 230 235 240

Lys Glu Phe Thr Tyr Met Ile Asn Phe Gly Arg Gly Gln Asn Tyr Trp  
245 250 255

Glu His Pro Tyr Gln Lys Ser Asp Gln Pro Lys Gln Tyr Glu Gln His  
260 265 270

Leu Thr Asp Tyr Glu Lys Ile Lys Glu Gly Lys Pro Leu Asp Lys Phe  
275 280 285

Gly Asn Ile Tyr Asp Tyr His Tyr Glu His Ser Ser Pro Ser Ser Thr  
290 295 300

Lys Ser Ser Ser Pro Ser Asn Val Lys Ser Ala Ser Leu Ala Thr Arg  
305 310 315 320

Leu Met Lys Lys Phe Lys Ala Glu Ile Arg Asp Phe Phe Gly Ile Ser  
325 330 335

Tyr Tyr Glu Lys Val Leu Ala Lys Tyr Lys Asp Asp Leu Glu  
340 345 350

<210> 3  
<211> 16  
<212> PRT  
<213> Plasmodium falciparum

<400> 3

Lys Pro Leu Asp Lys Phe Gly Asn Ile Tyr Asp Tyr His Tyr Glu His  
1 5 10 15

<210> 4  
<211> 12  
<212> PRT  
<213> Plasmodium falciparum

<400> 4

Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro  
1 5 10

<210> 5

<211> 13

<212> PRT

<213> Plasmodium falciparum

<400> 5

Lys His Lys Lys Leu Lys Gln Pro Gly Asp Gly Asn Pro  
1 5 10

<210> 6

<211> 23

<212> PRT

<213> Plasmodium falciparum

<400> 6

Lys Pro Lys Asp Glu Leu Asp Tyr Glu Asn Asp Ile Glu Lys Lys Ile  
1 5 10 15

Cys Lys Met Glu Lys Cys Ser  
20

<210> 7

<211> 21

<212> PRT

<213> Plasmodium falciparum

<400> 7

Asp Ile Glu Lys Lys Ile Cys Lys Met Glu Lys Cys Ser Ser Val Phe  
1 5 10 15

Asn Val Val Asn Ser  
20

<210> 8

<211> 9

<212> PRT

<213> Plasmodium falciparum

<400> 8

Trp Ser Pro Cys Ser Val Thr Cys Gly  
1 5

<210> 9

<211> 9

<212> PRT  
<213> Plasmodium falciparum

<400> 9

Lys Pro Ile Val Gln Tyr Asp Asn Phe  
1 5

<210> 10  
<211> 8  
<212> PRT  
<213> Plasmodium falciparum

<400> 10

Lys Pro Asn Asp Lys Ser Leu Tyr  
1 5

<210> 11  
<211> 18  
<212> PRT  
<213> Plasmodium falciparum

<400> 11

Asn Ser Gly Cys Phe Arg His Leu Asp Glu Arg Glu Glu Cys Lys Cys  
1 5 10 15

Leu Leu

<210> 12  
<211> 19  
<212> PRT  
<213> Plasmodium falciparum

<400> 12

Glu Asp Ser Gly Ser Asn Gly Lys Lys Ile Thr Cys Glu Cys Thr Lys  
1 5 10 15

Pro Asp Ser

<210> 13  
<211> 17  
<212> PRT  
<213> Plasmodium falciparum

<400> 13

Gly Ile Ser Tyr Tyr Glu Lys Val Leu Ala Lys Tyr Lys Asp Asp Leu  
1 5 10 15

Glu

<210> 14  
<211> 8  
<212> PRT  
<213> Plasmodium falciparum

<400> 14

Ser Asn Thr Phe Ile Asn Asn Ala  
1 5

<210> 15  
<211> 8  
<212> PRT  
<213> Plasmodium falciparum

<400> 15

Gly Gln His Gly His Met His Gly  
1 5

<210> 16  
<211> 18  
<212> PRT  
<213> Plasmodium falciparum

<400> 16

Asp Gly Asn Cys Glu Asp Ile Pro His Val Asn Glu Phe Ser Ala Ile  
1 5 10 15

Asp Leu

<210> 17  
<211> 18  
<212> PRT  
<213> Plasmodium falciparum

<400> 17

Gly Asn Ala Glu Lys Tyr Asp Lys Met Asp Glu Pro Gln His Tyr Gly  
1 5 10 15

Lys Ser

<210> 18  
<211> 19  
<212> PRT  
<213> Plasmodium falciparum

<400> 18

Asp Gln Pro Lys Gln Tyr Glu Gln His Leu Thr Asp Tyr Glu Lys Ile  
1 5 10 15

Lys Glu Gly

<210> 19

<211> 22

<212> PRT

<213> Plasmodium falciparum

<400> 19

Glu Phe Thr Tyr Met Ile Asn Phe Gly Arg Gly Gln Asn Tyr Trp Glu  
1 5 10 15

His Pro Tyr Gln Lys Ser  
20

<210> 20

<211> 19

<212> PRT

<213> Plasmodium falciparum

<400> 20

Asn Glu Arg Glu Asp Glu Arg Thr Leu Thr Lys Glu Tyr Glu Asp Ile  
1 5 10 15

Val Leu Lys

<210> 21

<211> 8

<212> PRT

<213> Plasmodium falciparum

<400> 21

Leu Thr Pro Leu Glu Glu Leu Tyr  
1 5

<210> 22

<211> 17

<212> PRT

<213> Plasmodium falciparum

<400> 22

Ser Ser Pro Ser Ser Thr Lys Ser Ser Pro Ser Asn Val Lys Ser Ala  
1 5 10 15



Ser

<210> 23  
<211> 17  
<212> PRT  
<213> Plasmodium falciparum

<400> 23

Leu Ala Thr Arg Leu Met Lys Lys Phe Lys Ala Glu Ile Arg Asp Phe  
1 5 10 15

Phe

<210> 24  
<211> 15  
<212> PRT  
<213> Plasmodium falciparum

<400> 24

Gln Tyr Ile Lys Ala Asn Ser Lys Phe Ile Gly Ile Thr Glu Leu  
1 5 10 15

<210> 25  
<211> 22  
<212> PRT  
<213> Honey bee

<400> 25

Met Lys Phe Leu Val Asn Val Ala Leu Val Phe Met Val Val Tyr Ile  
1 5 10 15

Ser Tyr Ile Tyr Ala Asp  
20

<210> 26  
<211> 6  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Synthetic

<400> 26

His His His His His His  
1 5